Data Collection Activity **Name** _____
TIC TOC

The data we have collected and graphed is a distance (in L2) vs. time (in L1) scatterplot of the racquetball as it)wings back and forth. It appears to produce a sinusoidal pattern, so we will attempt to fit our data with a sinusoidal function first in the form:

$$y = A\cos(B(x - C)) + D$$

We need to find values for **A**, **B**, **C**, and **D**.

1. Find the value of **C** first. Explain what the value of **C** represents.

C represents _____

Since we are using a cosine function, trace to the point on the scatterplot where the value of **C** can be found.

C = _____

2. Now find the value of **D**. Explain what the value of **D** represents.

D represents _____

This should be the **average** of the "highest value" on the scatterplot and the "lowest value". By tracing, find these values, and show the arithmetic used to find **D**.

D = _____

3. Now find the value of **A**. You already have all of the information to find **A**. Show the arithmetic used to find **A**.

A = _____

4. Finally, find the value of **B**. How many periods of the cosine function are on your scatterplot? To find an accurate value for **B**, trace to the initial point of the cosine function (which, actually, is the value of **C**) and then to the final point of the last period of the function. You should be able to find one period of the function if you subtract these two values and divide by the number of periods. Show the arithmetic used and record this. Now you can find **B**. (Don't forget you need to use the number 2π to find **B**.) Record the value of **B**.

One Period: _____ seconds **B** = _____

5. So, record the final **cosine function** that fits your data.

y = _____

Enter this function into **Y1** of your calculator and graph it. If it doesn't fit the data, find your mistake!

6. Which of the values of **A, B, C,** and **D** would change if we used a **sine function** instead of a **cosine function**. (There is only one!) Find this new value (by tracing) and write and record the equation which models this motion in the form:

$$y = A\sin(B(x-C))+D$$

y = _____

7. We also have the "velocity" data in L3 of our calculator. Set up and graph a scatterplot of the velocity vs. time data. This scatterplot shows the **velocity** of the racquetball at a specific time as it swings back and forth. (In calculus, there is a very important relationship between the "position" of a moving object at a certain time, and the "velocity" of the object at that time.) Note that this relationship is also sinusoidal. Again, find values for **A, B, C,** and **D** as above and find a sinusoidal function for the velocity vs. time relationship.

A = _____ **B** = _____

C = _____ **D** = _____

The function is: y = _____

8. Finally, let's look at one more relationship. Set up and graph a scatterplot between the "distance" data in L2, and the "velocity" data in L3. This result will be a surprise!

9. This type of relationship was discussed in class. By tracing (and using a little arithmetic), find the model that fits this data. To see if it is correct, solve for **y** in terms of **x** and graph the functions with the scatterplot. If it doesn't fit the data, find your mistake!

y = _____